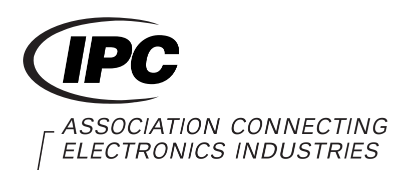


IPC-2524

PWB Fabrication Data Quality Rating System

IPC-2524

February 1999

A standard developed by IPC

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www.ipc.org

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In May 1995 the IPC's Technical Activities Executive Committee adopted Principles of Standardization as a guiding principle of IPC's standardization efforts.

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- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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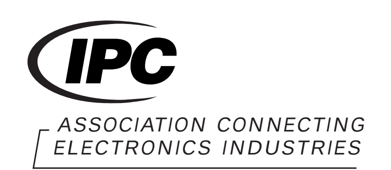
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IPC-2524

PWB Fabrication Data Quality Rating System

Developed by the CAD-CAM Users Improvement Roundtable (2-12) of the Data Generation and Transfer Committee (2-10) of IPC

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Board Fabrication Data Task Group (2-11j) of the Data Generation and Transfer Committee (2-10) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Tables

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PWB Fabrication Data Quality Rating System

1 SCOPE

This document describes a PWB fabrication data quality rating system used by fabricators to evaluate the incoming data package integrity. Printed board designers can also use this system as an output quality check.

2 DATA CLASSIFICATION & RATING

2.1 Data Rating Level Categories There are four data rating category levels. These levels correspond to a hierarchy of data integrity. The conformance to each level is provided using a rating scale ranking from zero to ten. A ''10'' rating requires no modifications to the PWB data. A ''0'' score implies that the fabrication tooling process is halted until the issues are completely addressed. The data rating categories are presented in Table 1.

Table 1 Data Rating Classifications

Level	Description	Scale
1	Package completeness	0 - 10
2	Data completeness	0 - 10
3	Conformance to customer design rules (DRC)	0 - 10
4	Conformance to fabricator design rules (DFM)	0 - 10

2.2 General Requirements Data integrity issues are classified into two categories:

Critical — The data that is provided is insufficient to create fabrication tooling. The tooling process is halted until these issues are resolved. Any critical issue automatically generates a maximum deduction of ''10.'' Evaluation of non-critical issues is not required.

Non-Critical — These problems may reduce the printed board quality and/or fabrication yield and slow down the tooling process. Although not show stoppers, the CAM engineer will be required to stop the tooling process to address these issues. These problems may also require manual editing of the PWB database. They will increase the fabrication tooling time. Non-critical issues are weighted to reflect their severity.

All categories start with a base rating of ten (10). Any critical issue automatically decrease the rating score to the minimum of zero (0). Non-critical issues have points subtracted for each discrepancy down to a value of one (1). For example, if there are no critical issues and four non-critical issues (with a severity weighting of 1) noted in the same category, the rating will be ''6'' (10 - 4).

3 PACKAGE COMPLETENESS (LEVEL 1)

Printed board fabricators use electronic data to generate production tools utilizing CAM systems. A minimum set of data is required to proceed with tool generation. If this minimum is not contained in the data package, the tooling process is halted while the missing information is requested and delivered. Data that is not provided electronically must be manually entered into the CAM system or copied and distributed into manufacturing. Missing files also enhance the probability of errors being incorporated during tooling and fabrication. Manual data editing and entry may inadvertently incorporate errors.

3.1 Critical Problems The following critical problems are those that cannot be resolved without customer involvement. Customer involvement and contact is generally conducted via faxes, direct meetings and e-mail. Table 2 presents the minimum files and information that is required to create fabrication tooling. The minimum rating of zero (0) is required if any of these problems are encountered.

Table 2 Complete Package Critical Problems

Critical Problems
Missing PWB artwork file(s)
Missing fabrication drawing/file(s)
Missing README file
Missing aperture information/file for 274-D artwork files
Missing netlist, when a netlist test is required
Drill file(s) and layer connectivity (blind and buried via layer combinations) not specified
Sender not identified
Bad or unknown compression
Corrupted files

3.1.1 Missing PWB Artwork File(s) The PWB artwork files are required to provide the electronic data which is required to fabricate each layer, such as copper, drill and solder mask layers.

3.1.2 Missing Fabrication Drawing/File The fabrication file presents mechanical board information and critical dimensioning. Fabrication notes are also included. It is required in conjunction with the artwork files.

3.1.3 Missing README File The README file is created in ASCII and provides information on what each of the electronic files is used for and how many should be included. It may also include special instructions for how to combine files.

3.1.4 Missing Aperture Information/File for 274-D Artwork Files The aperture file is used to provide D-Code

information for the 274-D Gerber files. This is not required for 274-X or other data formats.

3.1.5 Missing Netlist, When a Netlist Test Is Required A netlist, which is extracted from the original CAD database, is required when netlist test or data verification is required. The fabricator may extract a netlist from the interpreted data file and compare it back to the provided netlist. This verifies that no connectivity data corruption has occurred during the initial data extraction.

3.1.6 Drill File(s) and Layer Connectivity (Blind and Buried Via Layer Combinations) Drill files are required to provide all drilled hole locations. Printed boards with blind and buried vias should have a note on the fabrication print that specifies which files are utilized between specific layers.

3.1.7 Sender Not Identified The README file shall include text which indicates who sent the data to the fabricator. It should include the name of the company, division (if applicable), contact name, telephone number, fax number and e-mail address.

3.1.8 Bad or Unknown Compression Electronic files are generally compressed prior to being sent. This minimizes memory size and transmission times. The file cannot be de-compressed if it has an unknown compression technique. The file may fail de-compression, which will also make it unusable. A new file must be sent to correct this issue.

3.1.9 Corrupted Files The corrupted file has been de-compressed successfully, but is does not conform to a valid protocol or format. A new file must be sent to correct this issue.

3.2 Non-Critical Problems Non-critical problems are those that can be resolved without customer involvement. Table 3 presents the non-critical problems of package completeness. Each item has been weighted to reflect their severity. Non-critical issues have points subtracted for each discrepancy down to a value of one (1).

Table 3 Electronic File Non-Critical Problems

Non-Critical Problems	Points
Non-electronic fabrication drawing	1
Missing netlist, if netlist test is not required	2
Non-electronic aperture list	4
Missing rout/profile file	1

3.2.1 Non-Electronic Fabrication Drawing A non-electronic fabrication print will require that paper copies be distributed for production. Production or tooling will stop if the print is damaged or lost. Electronic prints allow multiple copies to be readily created and the master can be electronically archived.

3.2.2 Missing Netlist, if Netlist Test Is Not Required A netlist that is extracted from the CAD system should be sent with the CAD database. A netlist test can also be used for an incoming data netlist comparison, electrical test, or both. This issue is considered non-critical because this requirement is not required for tooling and can be waived.

3.2.3 Non-Electronic Aperture List A hardcopy aperture list will be manually entered into the CAM system. An incorrectly entered aperture may not be discovered during the rest of the tooling process.

3.2.4 Missing Rout/Profile File A missing rout or profile file will require complete manual creation.

4 DATA QUALITY (LEVEL 2)

Level 2 rates the completeness, quality and accuracy of the PWB data files. All files that are required to begin printed board tooling shall be provided. They shall match and require no operator intervention to be used by the fabricator. Conformance to the OEM and fabricator design rules is not evaluated at this level.

4.1 Critical Problems The following critical problems are those that cannot be resolved without customer involvement. These problems generally are not resolvable by automated CAM software or a skilled data entry operator or Planning Engineer. Table 4 presents the minimum information that is required to create fabrication tooling. The minimum rating of zero (0) is required if any of these problems are encountered. The tooling process is halted until all of these issues are resolved.

Table 4 Data Quality Critical Problems

Critical Problems
Fabrication drawing is not legible
Missing fabrication drawing information
Missing PWB material information
Missing layer sequence and stackup

4.1.1 Fabrication Drawing Is Not Legible Electronic fabrication drawing illegibility is determined when it is plotted or printed. The plotted quality must maintain good legibility after being copied. Hard copy fabrication drawings, such as fax's and plots, must maintain good legibility after two generations of copies are created.

4.1.2 Missing Fabrication Drawing Information All mechanical and non-artwork information that is not included in the README file or specifications provided, must be on the fabrication print. This includes items such

as all printed board dimensions and tolerances and reference specifications.

4.1.3 Missing PWB Material Information The material requirements must be provided in the fabrication drawing or in the specifications provided.

4.1.4 Missing Layer Sequence and Stackup The layer sequence shows the order that the layers are fabricated in the printed board (e.g., Layer 1 is top copper, Layer 2 is next, Layer 3, then Layer 4 is the bottom side copper layer). It is preferred that the CAD layer file names are references to the actual board layer numbers. This will ensure that layers are not inadvertently transposed. The stackup also provides the layer spacing and tolerance information. Impedance values and tolerances are also included in the stackup information.

4.2 Non-Critical Problems Non-critical problems are those that can be resolved without customer involvement. Table 5 presents the non-critical problems of data quality. Each item has been weighted to reflect their severity. Non-critical issues have points subtracted for each discrepancy down to a value of one (1).

Table 5 Data Quality Non-Critical Problems

Non-Critical Problems	Points
Rename layers, align artwork layers	1
Copy soldermask layer or create a layer	1
Substitute flashes for draws of test points & pads	4
Type in thermals	2
Delete Fab lines (only when tips are connected)	1

4.2.1 Rename Layers, Align Artwork Layers Layers should be numbered in the order and system that the fabricator uses in their CAM software. All of the layers should automatically be aligned to each other when the files are extracted. Individual layers should not require shifting or scaling.

4.2.2 Copy Soldermask Layer or Create a Layer In many designs, a single layer is used multiple times in the same printed board. This is common for soldermask layers. The layer should be copied and re-named in the CAD database prior to sending the database to the fabricator. No layers should be created by the fabricator.

4.2.3 Substitute Flashes for Draws of Test Points & Pads CAM systems utilize a significant mount of intelligent, automated editing. Most of the automation requires that printed board features, such as component pads and test points, be created with flash apertures and not drawn. Test fixture software assigns test points to flashed pads that do not have soldermask over them. Drawn pads must be manually converted into flashed pads during data entry or test fixture program generation.

4.2.4 Type in Thermals All thermal pads should be included in the database. If they are excluded, it will require manual entry during the data input operation at the fabricator.

4.2.5 Delete Fab Lines (only when tips are connected) Fab lines are required to be manually deleted for boards that have gold contacts (tips) which will be electroplated.

5 CONFORMANCE TO CUSTOMER DESIGN RULES (DRC) (LEVEL 3)

The data provided will be analyzed to determine if it complies with the specifications and drawings that are provided by the Original Equipment Manufacturer (OEM). Customer design rules include fabrication requirements which are provided by the designer, all assemblers and final system reliability and quality requirements. It is important to ensure that conflicting requirements do not exist between all of the specifications.

OEM specifications/ documentation may consist of the following (and in order of precedence):

1. Technical deviations agreed on by customer and fabricator.
2. Purchase order
3. Customer Engineering Change Order (ECO) or equivalent
4. Fabrication drawings and/or README file
5. PWB electronic data files
6. OEM general specification(s)
7. PWA assembly acceptance specification(s)
8. Documentation Bill-Of-Materials (BOM)

5.1 Critical Problems The following critical problems are those that cannot be resolved without customer involvement. Table 6 presents the minimum information that is required to create fabrication tooling. The minimum rating of zero (0) is required if any of these problems are encountered.

Table 6 Customer DRC Critical Problems

Critical Problems
PWB data does not match fabrication drawing
PWB array data does not match fabrication drawing
OEM and Assembler specifications conflict
Extracted netlist does not match supplied netlist
Drill layers do not match PWB artwork files

5.1.1 PWB Data Does Not Match Fabrication Drawing Conflicting information between the printed board graphical files and the fabrication drawing includes items such as wrong dimensions, missing layers and additional layers.

5.1.2 PWB Array Data Does Not Match Fabrication Drawing The fabrication drawing specifies a different

sub-panel array than the PWB data provides. For example, a 2 x 4 array is specified on the drawing and a 4 x 8 is provided in the data. This also includes sub-panel rail dimensions and attributes.

5.1.3 OEM and Assembler Specifications Conflict The OEM provides a fabrication acceptance specification. The assembly is performed by one or more sub-contract assemblers, each with their own fabrication acceptance specification. There should not be any conflicting specifications when these documents are compared.

5.1.4 Extracted Netlist Does Not Match Supplied Netlist The fabricator planner extracts a connectivity netlist and compares it to the netlist that is provided with the PWB database. When the two netlists conflict, it must be resolved. Failure to resolve this conflict could result in creating a PWB database that is electrically non-functional.

5.1.5 Drill Layers Do Not Match PWB Artwork Files The drill files and summary hole count table on the fabrication print must match. This includes the total hole quantity. All individual hole quantities much also match.

5.2 Non-Critical Problems Non-critical problems are those that can be resolved without customer involvement. The customer should be contacted prior to rectifying the conflicting specifications. Table 7 presents the non-critical problems of the design rule check. Each item has been weighted to reflect their severity. Non-critical issues have points subtracted for each discrepancy down to a value of one (1).

Table 7 Customer DRC Non-Critical Problems

Non-Critical Problems	Points
PWB data conflicts with OEM specifications	3
PWB data conflicts with PWA specifications	3
Fabrication drawing conflicts with OEM specification	2
Fabrication drawing conflicts with PWA specification	1

5.2.1 PWB Data Conflicts with OEM Specifications The PWB database violates requirements that are established in the OEM fabrication specifications. The database must be updated or a waiver must be provided.

5.2.2 PWB Data Conflicts with PWA Specifications The PWB database violates requirements that are established in the PWA fabrication specifications. The database must be updated or a waiver must be provided.

5.2.3 Fabrication Drawing Conflicts with OEM Specification The printed board fabrication drawing violates requirements that are established in the OEM fabrication specifications. The drawing must be updated or a waiver must be provided.

5.2.4 Fabrication Drawing Conflicts with PWA Specification The printed board fabrication drawing violates requirements that are established in the PWA fabrication specifications. The drawing must be updated or a waiver must be provided.

6 CONFORMANCE TO FABRICATOR DESIGN RULES (DFM) (LEVEL 4)

The data will be analyzed to determine if it conforms to the Design For Manufacturability (DFM) guidelines that are utilized by the fabricator. The purpose of this review is to highlight printed board features that will reduce the manufacturing yield. The intent of this review and feedback is to enhance the manufacturing yields, improve printed board reliability and/or reduce the fabrication cost.

6.1 Critical Problems The following critical problems are those that cannot be resolved without customer involvement. Table 8 presents the minimum information that is required to create fabrication tooling. The minimum rating of zero (0) is required if any of these problems are encountered.

Table 8 Fabricator DFM Critical Problems

Critical Problems
Parameter is outside of fabricator technical capabilities
Does not conform to fabricator reliability threshold

6.1.1 Parameter Is Outside of Fabricator Technical Capabilities A printed board feature or technology is outside of the fabricators capability. This may also include a combination of features or characteristics of the design database.

6.1.2 Does Not Conform to Fabricator Reliability Threshold A feature, or combination of features, may create an un-reliable condition in the fabricated printed board. This could include plated hole to power plane clearances, trace to edge of board clearances, etc. A decision must be made to fabricate the board with the attribute or modify the design database.

6.2 Non-Critical Problems Non-critical problems are those that can be resolved without customer involvement. Non-conformance to these items will produce lower yields or a higher escape level. The customer should be contacted prior to rectifying the conflicting specifications. Table 9 presents the non-critical problems. Each item has been weighted to reflect their severity. Non-critical issues have points subtracted for each discrepancy down to a value of one (1).

6.2.1 Non-Conformance to Feature Tolerances The printed board cannot be fabricated to the specified tolerances. Common issues are finished hole location tolerances, slot tolerances, and rout location tolerances.

Table 9 Fabricator DFM Non-Critical Problems

Non-Critical Problems	Points
Non-conformance to feature tolerances	1
Non-conformance to soldermask requirements	1
PWB data file size is very large	1
Incomplete surface finishes requirements	1
Non-conformance to finished hole requirements	1
Inefficient fabrication panel utilization	1
Non-conformance to rout, bevel, or score requirements	1
Non-conformance to PWB thickness tolerance	1
Non-conformance to impedance tolerance	1

6.2.2 Non-Conformance to Soldermask Requirements The soldermask requirements cannot be complied to with the provided design database. Common issues are soldermask clearance and web widths.

6.2.3 PWB Data File Size Is Very Large The database is too large for the software. Common issues are large plane areas utilizing small drawn vectors (0.025 mm) and too many layers.

Plane areas on mixed plane and signal layers should be contoured versus filled with drawn vectors. Drawn planes will substantially increase automated design rules check run times.

6.2.4 Incomplete Surface Finish Requirements No clear indication of type or tolerances for metallic or organic surface finish requirements for lands for component mounting, board edge connector contacts, and other component mounting technologies.

6.2.5 Non-Conformance to Finished Hole Requirements Drilled hole diameter and tolerances cannot be met for either supported or unsupported holes. This is usually related to hole to board aspect ratio, pad to hole tolerances, or location tolerance specification.

6.2.6 Inefficient Fabrication Panel Utilization The board size cannot be placed into the fabrication panel efficiently. This could include items such as actual board dimensions and coupon requirements.

6.2.7 Non-Conformance to Rout, Bevel, or Score Requirements The board cannot be fabricated with the specified rout, bevel, or score requirements. This generally involves tolerances or non-standard combinations of features.

6.2.8 Non-Conformance to PWB Thickness Tolerance The board cannot be fabricated per the specified thickness tolerance. This can be a result of too many layers being included for a given thickness. A tolerance may be specified too tight. There may also be insufficient thickness provided to allow compliance with the impedance requirements.

6.2.9 Non-Conformance to Impedance Tolerance Compliance with the specified impedance and/or tolerance cannot be maintained due to line width or dielectric spacing restrictions.

7 RATING SHEET

A typical rating form that can be used by the fabricator to compile the individual PWB data rating is provided on the next page. It can be faxed or e-mailed to the appropriate customer technical contact during the CAM and planning tooling process. The customer can use the feedback form to determine if PWB design corrective action should be implemented.

All categories start with a rating of ten (10). Any critical issue automatically requires the minimum rating of zero (0). Non-critical issues have points subtracted for each discrepancy down to a value of one (1).

The form can be downloaded from the IPC web page at www.gencam.org/docs. It is a Microsoft Excel 6.0 file. IPC can provide a 3.5″ floppy disk for MS-DOS computers.

IPC-2524 PWB Data Quality Rating Form

Customer Name:	Date:
PWB Part Number:	Revision:
Fabricator Part Number:	

Package Completeness Rating

Total:

Critical Problems (Enter 10 in Subtotal if any are encountered)

Subtotal: (max = 10)

(min = 0)
Total Rating =
10 - (critical subtotal
+ non-critical subtotal)

- Missing PWB artwork file(s)
- Missing fabrication drawing/file(s)
- Missing README file
- Missing aperture information/file for 274-D artwork files
- Missing netlist, when a netlist test is required
- Drill file(s) and layer connectivity not specified
- Sender not identified
- Bad or unknown compression
- Corrupted files

Non-Critical Problems (Add points for each issue encountered and enter in Subtotal)

Subtotal:

Problem	Points
Non-electronic fabrication drawing	1
Missing netlist, if netlist test is required	3
Non-electronic aperture list	4
Missing rout/profile file	1

Data Quality Rating

Total:

Critical Problems (Enter 10 in Subtotal if any are encountered)

Subtotal: (max = 10)

(min = 0)
Total Rating =
10 - (critical subtotal
+ non-critical subtotal)

- Fabrication drawing is not legible
- Missing fabrication drawing information
- Missing PWB material information
- Missing layer sequence and stackup

Non-Critical Problems (Add points for each issue encountered and enter in Subtotal)

Subtotal:

Problem	Points
Rename layers, align Gerber layers	1
Copy soldermask layer or create a layer	1
Substitute flashes for draws of test points & pads	4
Type in thermals	2
Delete Fab lines (only when tips are connected)	1

Conformance to Customer Design Rules (DRC)

Total:

Critical Problems (Enter 10 in Subtotal if any are encountered)

Subtotal: (max = 10)

(min = 0)
Total Rating =
10 - (critical subtotal
+ non-critical subtotal)

- PWB data does not match fabrication drawing
- PWB array data does not match fabrication drawing
- OEM and assembler specifications conflict
- Extracted netlist does not match supplied netlist
- Drill layers do not match PWB artwork files

Non-Critical Problems (Add points for each issue encountered and enter in Subtotal)

Subtotal:

Problem	Points
PWB conflicts with OEM specifications	3
PWB conflicts with PWA specifications	3
Fabrication drawing conflicts with OEM specification	2
Fabrication drawing conflicts with PWA specification	1

Conformance to Fabricator Design Rules (DFM)

Total:

Critical Problems (Enter 10 in Subtotal if any are encountered)

Subtotal: (max = 10)

(min = 0)
Total Rating =
10 - (critical subtotal
+ non-critical subtotal)

- Parameter is outside of fabricator capabilities
- Does not conform to fabricator reliability threshold

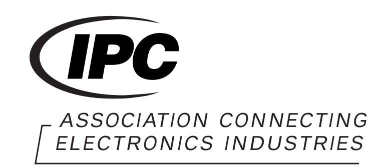
Non-Critical Problems (Add points for each issue encountered and enter in Subtotal)

Subtotal:

Problem	Points
Non-conformance to feature tolerances	1
Non-conformance to soldermask requirements	1
PWB data file size is very large	1
Incomplete surface finish requirements	1
Non-conformance to finished hole requirements	1
Inefficient fabrication panel utilization	1
Non-conformance to rout, bevel, or score requirements	1
Non-conformance to PWB thickness tolerance	1
Non-conformance to impedance tolerance	1

Rating Summary	Total
Package Completeness	
Data Quality	
Customer DRC	
Fabricator DFM	
Data Quality Score	

(40 is perfect data)



Standard Improvement Form

IPC-2524

The purpose of this form is to provide the Technical Committee of IPC with input from the industry regarding usage of the subject standard.

Individuals or companies are invited to submit comments to IPC. All comments will be collected and dispersed to the appropriate committee(s).

If you can provide input, please complete this form and return to:

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2215 Sanders Road
Northbrook, IL 60062-6135
Fax 847 509.9798

1. I recommend changes to the following:

___ Requirement, paragraph number __________

___ Test Method number __________, paragraph number __________

The referenced paragraph number has proven to be:

___ Unclear ___ Too Rigid ___ In Error

___ Other ____

2. Recommendations for correction:

____

____

____

____

3. Other suggestions for document improvement:

____

____

____

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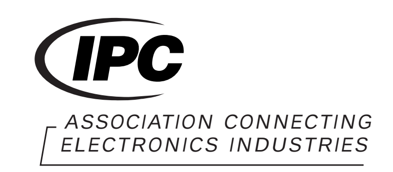
Submitted by:

Name ______________________ Telephone ______________

Company ______________________ E-mail ______________

Address ____

City/State/Zip ______________________ Date ______________



ANSI/IPC-T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits Definition Submission/Approval Sheet

The purpose of this form is to keep current with terms routinely used in the industry and their definitions. Individuals or companies are invited to comment. Please complete this form and return to:

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2215 Sanders Road
Northbrook, IL 60062-6135
Fax: 847 509.9798

SUBMITTOR INFORMATION:

Name: ______________________________

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City: ______________________________

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Telephone: ______________________________

Date: ______________________________

❑ This is a **NEW** term and definition being submitted.
❑ This is an **ADDITION** to an existing term and definition(s).
❑ This is a **CHANGE** to an existing definition.

Term	Definition

If space not adequate, use reverse side or attach additional sheet(s).

Artwork: ❑ Not Applicable ❑ Required ❑ To be supplied
❑ Included: Electronic File Name: ______________________________

Document(s) to which this term applies: ______________________________

Committees affected by this term: ______________________________

Office Use

IPC Office	**Committee 2-30**
Date Received: ____________	Date of Initial Review: ____________
Comments Collated: ____________	Comment Resolution: ____________
Returned for Action: ____________	Committee Action: ❑ Accepted ❑ Rejected
Revision Inclusion: ____________	❑ Accept Modify

IEC Classification

Classification Code • Serial Number

Terms and Definition Committee Final Approval Authorization:

Committee 2-30 has approved the above term for release in the next revision.

Name: ____________ Committee: IPC 2-30 Date: ____________

Technical Questions

The IPC staff will research your technical question and attempt to find an appropriate specification interpretation or technical response. Please send your technical query to the technical department via:

tel 847/509-9700
fax 847/509-9798
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e-mail: answers@ipc.org

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ChipNet@ipc.org

ChipNet forum is for discussion of flip chip and related chip scale semiconductor packaging technologies. It is cosponsored by the National Electronics Manufacturing Initiative (NEMI).

ComplianceNet@ipc.org

ComplianceNet forum covers environmental, safety and related regulations or issues.

DesignerCouncil@ipc.org

Designers Council forum covers information on upcoming IPC Designers Council activities as well as information, comment, and feedback on current design issues, local chapter meetings, new chapters forming, and other design topics.

Roadmap@ipc.org

The IPC Roadmap forum is the communication vehicle used by members of the Technical Working Groups (TWGs) who develop the IPC National Technology Roadmap for Electronic Interconnections.

IPCsm840@ipc.org

This peer networking forum is specific to solder mask qualification and use.

ADMINISTERING YOUR SUBSCRIPTION STATUS:

All commands (such as subscribe and signoff) must be sent to listserv@ipc.org. Please DO NOT send any command to the mail list address, (i.e.<mail list> @ipc.org), as it would be distributed to all the subscribers.

Example for subscribing:
To: LISTSERV@IPC.ORG
Subject:
Message: subscribe TechNet Joseph H. Smith

Example for signing off:
To: LISTSERV@IPC.ORG
Subject:
Message: sign off DesignerCouncil

Please note you must send messages to the mail list address ONLY from the e-mail address to which you want to apply changes. In other words, if you want to sign off the mail list, you must send the signoff command from the address that you want removed from the mail list. Many participants find it helpful to signoff a list when travelling or on vacation and to resubscribe when back in the office.

How to post to a forum:

To send a message to all the people currently subscribed to the list, just send to <mail list>@ipc.org Please note, use the mail list address that you want to reach in place of the <mail list> string in the above instructions.

Example:
To: TechNet@IPC.ORG
Subject: <your subject>
Message: <your message>

The associated e-mail message text will be distributed to everyone on the list, including the sender. Further information on how to access previous messages sent to the forums will be provided upon subscribing.

For more information, contact Hugo Scaramuzza
tel 847/790-5312
fax 847/509-9798
e-mail: scarhu@ipc.org
www.ipc.org/html/forum.htm

BENEFITS OF IPC MEMBERSHIP

IPC World Wide Web Page www.ipc.org

Our home page provides access to information about upcoming events, publications and videos, membership, and industry activities and services. Visit soon and often.

Education and Training

IPC conducts local educational workshops and national conferences to help you better understand emerging technologies. National conferences have covered Ball Grid Array and Flip Chip/Chip Scale Packaging. Some workshop topics include:

Printed Wiring Board Fundamentals
Troubleshooting the PWB Manufacturing Process
Choosing the Right Base Material Laminate
Acceptability of Printed Boards
New Design Standards
High Speed Design
Design for Manufacturability
Design for Assembly
Designers Certification Preparation

IPC video tapes and CD-ROMs can increase your industry know-how and on the job effectiveness.

For more information on programs, contact John Riley
tel 847/790-5308 fax 847/509-9798
e-mail: rilejo@ipc.org www.ipc.org

For more information on IPC Video/CD Training, contact Mark Pritchard
tel 505/758-7937 ext. 202 fax 505/758-7938
e-mail: markp@ipcvideo.org www.ipc.org

Training and Certification

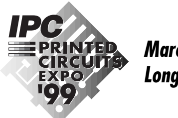
IPC-A-610 Training and Certification Program

"The Acceptability of Electronic Assemblies" (ANSI/IPC-A-610) is the most widely used specification for the PWB assembly industry. An industry consensus Training and Certification program based on the IPC-A-610 is available to your company.

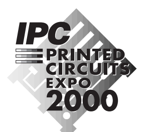
For more information, contact John Riley
tel 847/790-5308 fax 847/509-9798
e-mail: rilejo@ipc.org www.ipc.org/html/610.htm

IPC Printed Circuits Expo

IPC Printed Circuits Expo is the largest trade exhibition in North America devoted to the PWB industry. Over 90 technical presentations make up this superior technical conference.



March 16-18, 1999
Long Beach, California



April 4-6, 2000
San Diego, California

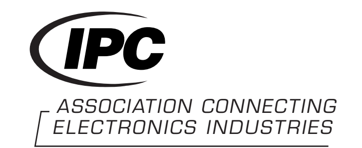
For exhibitor information,
Contact: Ken Romeo
tel 630-434-7779

For registration information:
tel 847/790-5361 fax 847/509-9798
e-mail: registration@ipc.org www.ipc.org

How to Get Involved

The first step is to join IPC. An application for membership can be found on page 74. Once you become a member, the opportunities to enhance your competitiveness are vast. Join a technical committee and learn from our industry's best while you help develop the standards for our industry. Participate in market research programs which forecast the future of our industry. Participate in Capitol Hill Day and lobby your Congressmen and Senators for better industry support. Pick from a wide variety of educational opportunities: workshops, tutorials, and conferences. More up-to-date details on IPC opportunities can be found on our web page: www.ipc.org

For information on how to get involved, contact:
Jeanette Ferdman, Membership Manager
tel 847/790-5309 fax 847/509-9798
e-mail: JeanetteFerdman@ipc.org www.ipc.org



Application for Site Membership

Please check appropriate category

Thank you for your decision to join IPC. IPC Membership is **site specific,** which means that IPC member benefits are available to all individuals employed at the site designated on the other side of this application.

To help IPC serve your member site in the most efficient manner possible, please tell us what your facility does by choosing the most appropriate member category.

■ **Independent Printed Board Manufacturers**

Our facility manufactures and sells to other companies, printed wiring boards or other electronic interconnection products on the merchant market.

What products do you make for sale?

- ☐ One-sided and two-sided rigid printed boards
- ☐ Multilayer printed boards
- ☐ Flexible printed boards
- ☐ Flat cable
- ☐ Hybrid circuits
- ☐ Discrete wiring devices
- ☐ Other interconnections

Name of Chief Executive Officer/President____

■ **Independent Printed Board Assemblers EMSI companies**

Our facility assembles printed wiring boards on a contract basis and/or offers other electronic interconnection products for sale.

- ☐ Turnkey
- ☐ SMT
- ☐ Chip Scale Technology
- ☐ Through-hole
- ☐ Mixed Technology
- ☐ Consignment
- ☐ BGA

Name of Chief Executive Officer/President____

■ **OEM – Manufacturers of any end product using PCB/PCAs or Captive Manufacturers of PCBs/PCAs**

Our facility purchases, uses and/or manufactures printed wiring boards or other electronic interconnection products for our own use in a final product. Also known as original equipment manufacturers (OEM).

Is your interest in:

- ☐ purchasing/manufacture of printed circuit boards
- ☐ purchasing/manufacturing printed circuit assemblies

What is your company's main product line?

____

■ **Industry Suppliers**

Our facility supplies raw materials, machinery, equipment or services used in the manufacture or assembly of electronic interconnection products.

What products do you supply?

____

■ **Government Agencies/ Academic Technical Liaisons**

We are representatives of a government agency, university, college, technical institute who are directly concerned with design, research, and utilization of electronic interconnection devices. (Must be a non-profit or not-for-profit organization.)

Please be sure to complete both pages of application.





Company Name ______________________________

Street Address ______________________________

City ____________ State ____________ Zip ____________ Country ____________

Main Phone No. ____________ Fax ____________

Primary Contact Name ______________________________

Title ____________ Mail Stop ____________

Phone ____________ Fax ____________ e-mail ____________

Senior Management Contact ______________________________

Title ____________ Mail Stop ____________

Phone ____________ Fax ____________ e-mail ____________

Please check one:

❏ $1,000.00 Annual dues for Primary Site Membership (Twelve months of IPC membership begins from the time the application and payment are received)

❏ $800.00 Annual dues for Additional Facility Membership: Additional membership for a site within an organization where another site is considered to be the primary IPC member.

❏ $600.00** Annual dues for an independent PCB/PWA fabricator or independent EMSI provider with annual sales of less than $1,000,000.00. **Please provide proof of annual sales.

❏ $250.00 Annual dues for Government Agency/University/not-for-profit organization

TMRC Membership ❏ Please send me information on Membership in the Technology Marketing Research Council (TMRC)

AMRC Membership ❏ Please send me information for Membership in the Assembly Marketing Research Council (AMRC)

Payment Information

Enclosed is our check for $____________________

Please bill my credit card: (circle one) MC AMEX VISA DINERS

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Authorized Signature ______________________________________

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